Citation:

Reid M, Hammersley R, Hill AJ, Skidmore P. Long-term dietary compensation for added sugar: Effects of supplementary sucrose drinks over a four-week period. *Br J Nutr.* 2007 Jan; 97(1): 193-203.

PubMed ID: 17217576

Study Design:

Randomized Controlled Trial

Class:

A - Click here for explanation of classification scheme.

Research Design and Implementation Rating:

POSITIVE: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

To examine the effects of supplementary soft drinks added to the diet over four weeks on dietary intake, mood and body mass index (BMI) in normal weight women.

Inclusion Criteria:

- Female
- Aged 20 to 55 years old
- Normal weight (BMI 17.0 to 24.9kg/m^2).

Exclusion Criteria:

- Currently dieting or exercising to lose weight
- Dislike of popular sweet carbonated drinks
- Being diabetic, pregnant or lactating
- Suffering from any serious physical or mental health problem or being on any medication that would interfere with mood, such as antidepressants
- Inability to take part in the study for five consecutive weeks.

Description of Study Protocol:

Recruitment

Advertising around university and in the local community, using posters and local newspapers.

Design

- The study took place over five weeks, including one week of baseline data collection

followed by four weeks of drink supplementation
- Drinks contained either sucrose or aspartame. Participants were either informed that they were receiving sugary drinks or ‘diet’ drinks; half were correctly informed about the drink content and half misinformed
- In addition, participants were recruited according to whether they were or were not currently watching their weight
- This resulted in a 2 x 2 x 2 design (sucrose vs. aspartame, drinks labeled sugar vs. labeled aspartame or diet, watcher vs. non-watcher).

Dietary Intake/Dietary Assessment Methodology

Food intake was measured with a seven-day diary during each week of the five-week study.

Blinding Used

Subjects received four bottles of drink per day in uniform bottles with the labeling manipulated. Participants were either informed that they were receiving sugary drinks or 'diet' drinks.

Intervention

- Each week of the four-week intervention, participants were given one week's supply of 28 test drinks and were instructed to drink a 250ml bottle at the specified times (11:00 a.m., 2:00 p.m., 6:00 p.m. and 8:00 p.m.) each day
- Sucrose supplements provided 1,800kJ per day and aspartame supplements provided 67kJ per day.

Statistical Analysis

- Differences in anthropometric, lipid and dietary measures were examined using general linear modelling with a repeated-measures design (week zero, one or four), with type of drink given and expectancy as fixed variables. In initial analyses, restraint status (watching or non-watching) was also included, but there were no effects of this manipulation so analyses reported exclude this variable
- Because there were multiple analyses, the significance level was set to $P<0.001$.

Data Collection Summary:

Timing of Measurements

Subjects attended the laboratory seven times, for initial screening, at the start of the baseline week, the start of each of the four intervention weeks and at the very end of the last week.

Dependent Variables

- Dietary intake (energy and nutrient intake)
- Body weight
- Mood.

Independent Variables

- Drinks sweetened with sugar or aspartame
- Sucrose supplements provided 1,800kJ per day and aspartame supplements provided 67kJ per day.

Control Variables

Activity levels.

Description of Actual Data Sample:

- *Initial N:* 161 women
- *Attrition (final N):* 133 women (17% attrition)
- *Age:* 31.8±9.1 years
- *Other relevant demographics:* Exercise (minutes per week) = 114±95
- *Anthropometrics:* BMI=22.5±2.8kg/m^2
- *Location:* United Kingdom.

Summary of Results:

Key Findings

- For those consuming the sucrose drink, energy intake was higher at week one [t (67 df) = 6.44; P<0.001] and at week four than at baseline [t (67 df) = 3.82; P<0.001] and week one and week four did not differ [t (67 df) = 1.81; P=0.075]. Women in the sucrose group consumed about 800kJ more energy per day; the supplements contained 1,800kJ
- After receiving aspartame, energy intake was marginally lower at week one [t (64 df) = 2.18; P<0.05] and at week four [t (64 df) = 2.0; P<0.05] than at baseline, and week one and week four did not differ [t (64 df) = 0.16;NS]
- Mean body weight at baseline was 61.35±8.37kg. There was a marginal effect of drink on body weight [F(10•20, 1.86) = 4.509; P<0.05], with more women who received the sucrose drink gaining some weight during the study and more women receiving aspartame losing weight. There was a non-significant trend for those receiving sucrose to gain weight.

Other Findings

- Normal weight women compensated for the added sucrose by reducing energy intake elsewhere, particularly choosing less carbohydrate in their free diets, but also reducing fat and protein intake
- There were no effects on appetite or mood.

Author Conclusion:

Sucrose satiates, rather than stimulates, appetite or negative mood in normal weight subjects. However, compensation was only partial for added sucrose; if sucrose were to be added to the diet, some weight gain might result in normal weight individuals.

Reviewer Comments:

Limitation: As indicated by authors, findings apply only to women of normal weight eating low-fat diets.

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions		
1.	Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies)	N/A
2.	Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	Yes
3.	Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?	Yes
4.	Is the intervention or procedure feasible? (NA for some epidemiological studies)	Yes

Validity Questions		
1.	**Was the research question clearly stated?**	Yes
1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	Yes
1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	Yes
1.3.	Were the target population and setting specified?	Yes
2.	**Was the selection of study subjects/patients free from bias?**	Yes
2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	Yes
2.2.	Were criteria applied equally to all study groups?	Yes
2.3.	Were health, demographics, and other characteristics of subjects described?	Yes
2.4.	Were the subjects/patients a representative sample of the relevant population?	Yes
3.	**Were study groups comparable?**	Yes
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	Yes
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	Yes
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	Yes

3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	N/A
3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	N/A
3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	**Was method of handling withdrawals described?**	???
4.1.	Were follow-up methods described and the same for all groups?	???
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	No
4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	Yes
4.4.	Were reasons for withdrawals similar across groups?	No
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
5.	**Was blinding used to prevent introduction of bias?**	???
5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	Yes
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	???
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	N/A
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
6.	**Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were interveningfactors described?**	Yes
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	Yes
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	Yes

6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	Yes
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	Yes
6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	Yes
6.6.	Were extra or unplanned treatments described?	N/A
6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	Yes
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	**Were outcomes clearly defined and the measurements valid and reliable?**	Yes
7.1.	Were primary and secondary endpoints described and relevant to the question?	Yes
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	Yes
7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	Yes
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	Yes
7.5.	Was the measurement of effect at an appropriate level of precision?	???
7.6.	Were other factors accounted for (measured) that could affect outcomes?	Yes
7.7.	Were the measurements conducted consistently across groups?	Yes
8.	**Was the statistical analysis appropriate for the study design and type of outcome indicators?**	Yes
8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	N/A
8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	Yes
8.6.	Was clinical significance as well as statistical significance reported?	Yes

8.7.	If negative findings, was a power calculation reported to address type 2 error?	N/A
9.	**Are conclusions supported by results with biases and limitations taken into consideration?**	Yes
9.1.	Is there a discussion of findings?	Yes
9.2.	Are biases and study limitations identified and discussed?	Yes
10.	**Is bias due to study's funding or sponsorship unlikely?**	Yes
10.1.	Were sources of funding and investigators' affiliations described?	Yes
10.2.	Was the study free from apparent conflict of interest?	Yes